Service Manual
Pressure Cylinder

X-STORE

Type: AH_271_1
version: AH_314_1
version: AH_314_2
version: AH_271_6

Type: AH_390_1
Type: AH_470_1

Manufactured by:

xperion

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Germany

TABLE OF CONTENTS

1. General safety instructions

1.1 Relevant Standards

In addition to this service manual, for the operation of CNG Systems, the following standards must be taken into account:

- ECE R 110
- ECE R 115
- DIN EN ISO 11439

1.2 Sign description

Prohibition signs	
	Work is allowed by authorized persons only
	No smoking
	Prohibition of fire and flames
Warning Signs	
	Warning of a danger point or safety note.
	Warning of cold surfaces.
Commandment signs	
	Use protective gloves.
	Use hearing protection

2. Environmental protection and waste disposal

X-Store cylinders are made of an HDPE liner, connection parts out of aluminum, stainless steel and carbon fibre reinforcement embedded in epoxy resin. These substances are environmentally harmless and can be disposed after 20 years.

In accordance to the above mentioned materials, the recycling processes should be arranged with the current state of the art technologies.

If the entire cylinder will be recycled, it must be disabled. For this purpose, a hole in the cylindrical wall of the cylinder with a diameter of at least 10mm must be drilled.

Prior to disposal, the tank must be washed with nitrogen several times, in order to prevent the formation of an ignitable mixture.

If under certain circumstances the pressure of the cylinder has to be released, (i.e. change of a cylinder due to superficial damage), local and country safety regulations should be followed.

Before venting the cylinder, it is imperative to check all connections and pipelines between the cylinder / valve and torch for leaks. This can be done with leak-detect-spray. The cylinder must be grounded with a suitable cable to prevent electrostatic charge. A fire extinguisher must be accessible.

In radius of 10 meters around the cylinder, smoking and fire is prohibited.

If the gas will be relieved without a torch into the environment, it is recommended to wear ear-protection, because a noise level of more than 110 dBA can occur.

In both cases it is important to note that the valve may cool down dramatically through the effusion of the gas. Therefore gloves must be worn.

3. Operating conditions

3.1. General

X-Store cylinders are designed for an operating pressure of 20 MPa (200 bar) at a surrounding temperature of 15℃.

The cylinders may only be filled to this pressure, with a working pressure of not more than 20 MPa (200 bar) at a surrounding temperature of 15℃ during the adjustments of the resulting temperatures within the cylinder.

This corresponds under normal operating conditions to a maximum of 26 MPa (260 bar). The maximum filling pressure should never exceed more than 26 MPa (260 bar) at any temperature.

The maximum useful life of the cylinder is 20 years in accordance with ECE R 110. This lifetime of a cylinder is shown on every cylinder label (see ECE R110 chapter 5.2.2), as well as in the documents of the cylinder.

During service, a periodical inspection according to chapter 5 must be carried out.

After the expiry of the useful life, the cylinder must be destroyed and disposed in accordance with the instructions from chapter 2.

3.2. Gas composition

It must be ensured that the natural gas (CNG) corresponds with the ECE R 110 chapter 4.5 regulations, when filling the cylinders.
The operator of the filling stations is responsible for this.

Arid Gas:

- Water vapour content <32mg/m^3
- Pressure dew point at 20 MPa minimum -9℃
- Hydrosulphide and other soluble sulphides <23mg/m^3
- Oxygen <1 Vol.%

Humid Gas:

- Water vapour content> 32mg/m^3

- Pressure dew point at 20 MPa > -9℃
- Hydrosulphide and other soluble sulphides <23mg/m^3
- Oxygen <1 Vol.%
- Carbon dioxide < 4 Vol.%
- Hydrogen <0,1 Vol.%

3.3. Temperature ranges

X-Store Cylinders are tested and homologated for a stabilized gas temperatures of -40 °C to +65 °C.

Exceeding this temperature range is not permitted at any time. Even short time exposure to temperatures >+65℃ during any hot work (e.g. welding, thermal cutting, etc.) close to the cylinder is forbidden. Furthermore the operator has to assure that the cylinder does not come in contact with any sparks caused by hot works.

3.4. Cylinder handling

Cylinders are not allowed to be transported and handled without any pressure.

To avoid injuries to the hands through loose fibre ends, gloves must be worn at all times.

Cylinders may never be lifted at the valves / adapters, because this might cause damages not seen during visual inspection. Even minor forces can cause a deformation of the electromagnetic device of the valve, which may cause a malfunction of the automatic sealing device.

When dealing with composite pressure cylinders, it is particularly important to ensure that no impact load (i.e. through falling cylinders) may occur.

To avoid abrasions at the cylinder's surface, rubber layers must be used.

When storing cylinders, the following points have to be considered:

- The cylinders must be secured against rolling or sliding.
- If valves or adapters are screwed into the cylinder, the openings must be closed with plastic plugs in order to eliminate the penetration of dirt particles.
- For long-term storage (more than one day), the cylinder must be protected against UV-radiation.
- Rubber layers should be used to avoid damage of the cylinder's surface by abrasion.

3.5. Behaviour after an accident or fire

3.5.1. Accident

If a cylinder has been involved in an accident and this incident resulted in a damage of the cylinder, it must be tested by the company xperion or an authorized partner to re-confirm its further suitability. It is important to provide all available documentation of the accident (i.e. photos). Without such testing, it is prohibited to use the damaged cylinder.

3.5.2. Fire

If a cylinder has been involved in an event of a fire, it must be decommissioned and destroyed according to chapter 2.

4. Installation instructions

All work on cylinders and gas equipment requires knowledgeable staff

4.1. Assembly of a cylinder into a vehicle

The service technician who is doing the assembly of the car with the CNG Cylinders has to find out the best space in the car.

In special the following points have to be taken into account.

- Container assembly shall be mounted at least 100mm from the exhaust system of the vehicle.

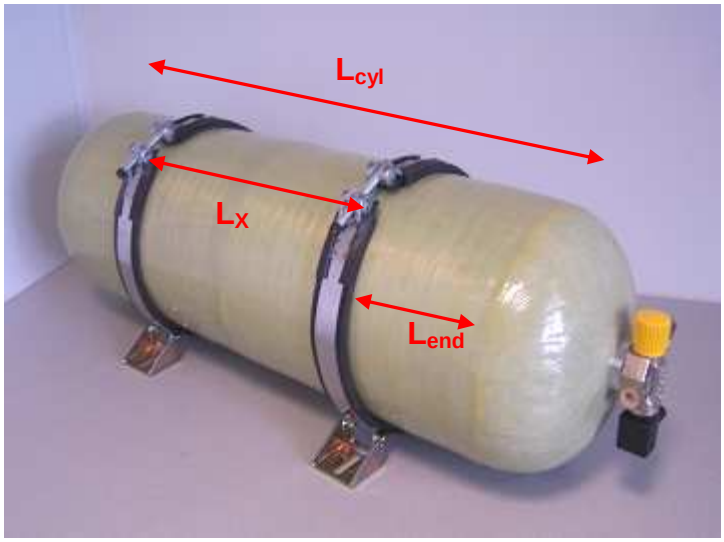
- If assembly in the undercarriage of the vehicle is planned, the cylinder must be sufficiently protected from road debris and contact.

- If assembly in the vehicle interior is planned, the cylinder must be sufficiently protected against loose articles (e.g. heavy tools) or aggressive media (e.g. solvents).

- Regulations ECE R110, ECE R115, and country regulations should be followed.

4.1.1. Bracket mounting

The distance between the strap-mountings must be at least ½-times the cylindrical length of the cylinder (L_x= 1/2* L_{cyl}). In general, the strap-mountings should be installed at the outer ends of the cylinder. Nevertheless, the distance to the cylinder-ends L_{end} should be at least 50 mm.



Picture 1

When using strap-mountings, rubber layers must always be between the strap and the cylinder. This rubber layer absorbs the axial and tangential expansion of the cylinder without damaging the surface of the cylinder.

xperion prescribes a rubber thickness of at least 2 mm. When using strap-mountings produced by e.g. the company “Hydac”, the rubber layer is part of the mounting-system for Type 4 cylinders.

As an example, cylinders type AH_271_1 with a diameter of 271mm have an expansion of the circumference of about 0.5% at working pressure. This equals an expansion of the circumference of 4.25mm or an expansion of the diameter of

1.35mm between 0 and 200 bar. The axial elongation is 0.4% or about 3 mm between 0 and 200 bar. Similar expansion percentages for the other cylinder sizes covered by this manual can be expected. If further clarification is required, please contact xperion or your local distributor.

4.1.2. Neck Mounting

The AH_271_6 has been specifically designed to allow for neck mounted assembly. A current listing of the containers suitable for the neck assembly can be supplied by contacting xperion or your local distributor.

With the neck assembly it is to be noted that there is a fixed bearing side (container neck with valve) and a floating bearing side. The mounting at the vehicle must be so implemented that it withstands oscillations with amplitude of 1,5mm with a frequency of 17 hertz for one duration of 122400 changes of load. On the floating bearing side a bushing must be planned, which can take up the axial shift of 0,4% and/or approx. 3mm.

4.2. Installation of valves

During assembly of valves, please follow, in accordance the points below.

1. Only xperion authorized valves and relief devices are to be used. For a listing of such approved devices please contact xperion or your local distributor.

2. Ensure that the thread of the valve and adapter is compatible to the cylinder threads. X-Store cylinders have a connecting thread of 1.125-12UNF.

3. Check all threads for damage and dirt. Remove dirt with a clean cloth. Damaged parts must be replaced.

4. Check that the o-rings and the o-ring groove have no damage. If necessary replace the o-ring.

5. Manually (by hand) screw the valve until it is firmly applied.

6. Tighten the valve with the matching specialty tool with a torque of 130 Nm. Applying a torque > 130Nm to the cylinder is not permitted.

7. Mark the transition from valve to the cylinder with a drop of sealing wax/paint.

8. Record the change of the valve in the documents.

9. Test the system cylinder / valve / for leaks.

4.3. Removal of valves and safety adapters

It is important to ensure that the cylinder is depressurized. The following steps should be followed.

To do so, the manual valve must be closed.

Afterwards, the automatic sealing device must be opened by applying 12 V (passenger car) or 24V (truck/bus). The ear protection must be worn, because the noise level through the out coming gas can reach more than 110 dba.

After the automatic sealing device has been opened, the manual valve must be opened slowly. If CNG effuses, the cylinder is not completely empty. In this case, please proceed as shown in chapter 2.

Once the tank is depressurized, the valve / adapter can be removed with a special tool. Before remounting the valve / adapter, the condition of the valve / adapter and the thread have to be checked. See also chapter 4.2.

For further instructions regarding the removal and service of the valve please refer to the valve manufacturer instructions available by contacting xperion or your local distributor.

5. Periodic Cylinder Inspection (“Gasanlagenprüfung” = GAP) according to ECE R 110

At regular intervals, however no longer than 48 months, cylinders for CNG use in vehicles must be inspected. The test intervals are defined within the ECE-R110 respectively within the regulations of each country. During the inspection, the cylinder is examined whether any inadmissible damages have occurred. Periodic inspections with water pressure tests and dismounting of the cylinder are no longer necessary.

Every vehicle run with CNG must be undertaken a GAP. For example, in Germany, the period between the last GAP and the next general vehicle inspection may never be longer than 12 months. Due to the inspection interval of 24 months between the general vehicle inspections of a passenger car, the maximum inspection interval adds up to 36 months. The ECE-R110 instructs that a visual inspection must be performed every three years. Similar regulations apply accordingly in other countries. National regulations should always be followed. If in doubt, please contact xperion or your local distributor.

5.1. Requirements for the auditor

The auditor must be in possession of a certificate that he has been trained according to the GAP or as required by National regulations. This GAP training instructs the safety and technology regulations when dealing with pressure cylinders and other CNG storage system components.

The GAP trainings are offered by various technical inspection authorities.

It is essential, that the auditor is in possession of this service manual in order to ensure that important information is understood.

All work performed on the cylinders and components are only allowed by trained and authorized staff only.

5.2. Procedure of the cylinder inspection

5.2.1. Examination of documents

At first the cylinders data must be recorded and be compared with the data from the logbooks (if applicable).

5.2.2. Data of the label (example)

Picture 2

NUR CNG/CNG ONLY	This cylinder is for compressed natural gas use only
xperion ALPHA Composites GmbH	Manufacturer of the cylinder
Do not use after	The maximum lifetime of a CNG cylinder. After exceeding this date, the cylinder must be decommissioned. Date is listed as mm/yyyy
ID number	Type number of cylinder. If applicable the version number.
Serial number	Continuous serial number of the cylinder. ID number and serial number together guarantee an explicit allocation of the cylinder
Volume	Nominal water volume in liter at ambient pressure
Empty weight	Weight of the cylinder without the valve in kg
Working pressure	Working pressure after temperature balancing. Directly after the filling of the cylinder, the pressure may exceed this pressure. 20 MPa = 200 bar = 2900 psi.
Permitted working temperature	-40°to +65℃ (-40℉ to +149℉).
Test pressure	Pressure, which is applied on the cylinder at the water-pressure-test in order to test the cylinder's

	strength. 30 MPa = 300 bar = 4350 psi
Date of first pressure test	Date on which the cylinder has first been tested and approved by the TÜV.
Month / year of approval	Date of approval through the certifying institute.
Type approval	Number which has been allocated after the approval by the certifying institute.

5.2.3. Optical control of the cylinder's surface

X-Store cylinders are partly handmade. Therefore small optical differences between the cylinders may occur.

Superficial cracks

The first pressure test during the manufacturing process of the cylinder may result in uncritical inter fibre failure. These inter fibre failure are small harmless cracks in the surface of the cylinder. The cracks usual occur in circumferential direction. When a lot of resin accumulates at the surface, cracks may also occur in axial direction. These cracks do not have an impact on the function of the cylinder.

This part of the inspection is considered passed, if the cracks are not running through the fibres.

In cases of doubt, xperion ALPHA Composites GmbH or your local distributor is to be informed.

Abrasion marks and scratches

Abrasion marks, scratches or scrapings, i.e. through loose tie straps or rubber supports, are without any harm to the cylinder, as long as they do not reach the fibre itself. It is important to find the reason for these damages before reinstalling the cylinder in order to avoid further damages.

When the scratches reach the fibre, the cylinder must be decommissioned.

This part of the test is considered as passed, if the scratches are within the resin layer, but not the first fibre layer.

In cases of doubt, xperion ALPHA Composites GmbH or your local distributor is to be informed.

Points of impact

Shock or impacts onto the cylinder may be difficult to find and to evaluate the effect of it. If the affected spot shows only small signs of scratches, the cylinders is still usable.

If the affected spot shows damage to the fibre, the cylinder must be decommissioned.

In cases of doubt, xperion ALPHA Composites GmbH or your local distributor is to be informed.

Loose fibre ends

Loose fibre and delamination of fibre ends are not acceptable. Depending on the degree of delamination, a repair at xperion ALPHA Composites may be feasible. To evaluate the level of damage, it may be helpful to send a digital photo to xperion ALPHA Composites GmbH or your local distributor.

In cases of doubt, xperion ALPHA Composites GmbH or your local distributor is to be informed.

5.2.4. Inspection of connected components

Control of the valve

The valve / piping adapter must be in faultless condition. Damaged components must be replaced.

It must be ensured that valves equipped with thermal release unit (out of a glass bulb) are completely intact, liquid is completely existent and no surface scratches occur. The glass bulb is usually about 10 – 15 mm long and filled with a coloured liquid (mostly red coloured liquid). The usual appearance of the thermal release unit is shown in picture 3.

Picture 3

Before unscrewing the valve or valve components, it must be ensured that the cylinder is depressurised. See also chapter 4.3.

Control of the Secondary TPRD

As necessary, a second TPRD may be added on the opposite side of the valve end. This is usually the case with cylinders longer than 1.6 meters.

The safety adapter is made out of a metalk body with a TPRD (thermal pressure release unit). It must be in faultless condition. Abrasions or bent parts are prohibited.

Please check that the glass bulb is completely intact at valves with a thermal pressure release device.

Before unscrewing the adapter or adapter components, it must be ensured that the cylinder is completely depressurised. See also chapter 4.3.

Leak test

xperion recommends using leak detection spray or soapsuds when leak testing composite cylinders. The testing by leak-measuring-machines (so-called sniffer devices) may cause wrong results due to the natural permeation of the CNG through the cylinder.

The evaluation of the leak test must be done under the regulations of the ECE-R110. Extract out of the 7th adjusted version from 3rd of February 2008, chapter 17.1.5:

“The system may not have permeable spots. That means that the system must be bubble-free for three minutes.”

Please consider, that small-sized bubbles may appear when using leak detection spray. These bubbles must disappear after a few seconds. These bubbles have nothing to do with permeation or leakage of the cylinder.

Should a cylinder or valve be permeable, a clear bubble growth can be detected.

5.2.5. Procedure of the leak test

The cylinder must be filled up to the working pressure of 200 bar. After filling, the cylinder must rest for at least 2 hours in order to gain stable pressure and stable temperature conditions. If the cylinder is heated due to the filling, the leak detecting spray or the soapsuds may evaporate, which causes incorrect test results.

The complete cylinder should be leak tested. Especially the connection: valve / cylinder / adapter must be tested, because these are the most critical joints.

If bubbles emerge within 3 minutes, the test has not passed. Leaking components must now be replaced and the leak test carried out again.

5.3. Checklist for the periodical inspection with X-Store cylinders

1. Serial number of the cylinder: _____

2. Year and month of the initial approval: _____

3. Date of last inspection: _____

4. Executing company, name of auditor: _____ _____

5. Test criteria

5.1. Superficial cracks not deeper than up to the first fibre layer?
☐ Yes ------- allowed ☐ No ----- not allowed

5.2. Abrasion marks and scratches not deeper than up to the first fibre layer?
☐ Yes ------- allowed ☐ No ----- not allowed

5.3. Points of impact are not, or only to a small degree existent?
☐ Yes ------- allowed ☐ No ----- not allowed

5.4. Loose fibre ends are non existent?
☐ Yes ------- allowed ☐ No ----- not allowed

5.5. Valve and safety adapters are not damaged?
☐ Yes ------- allowed ☐ No ----- not allowed

5.6. The complete cylinder and attached components are without any leaks?
☐ Yes ------- allowed ☐ No ----- not allowed

_____
Signature of authorized auditor

Each test criteria with "not allowed" errors causes the failure of the complete inspection. After a possible repair, the complete checklist must be processed again. The inspection has only been passed, if all cylinders positively tested.

6. Approach at failure of a cylinder

xperion keeps record on all incidents which occur with X-Store cylinders. If a cylinder fails during a pressure test, xperion must be informed. Please send the serial number of the cylinder and the reason for failure to contact address from chapter 7.

7. Contact address

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